JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

PS – Bot

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Abstract - The PS-BOT is a revolutionary personal assistance robot designed to significantly enhance daily living experiences. By integrating cutting-edge technology, such as the Autonomous Mobile Robot (AMR) processing system, the PS-BOT offers seamless navigation and interaction capabilities. Its advanced features include object detection, tracking, and face recognition, ensuring efficient assistance tailored to individual needs. Additionally, with GPS navigation and ROS (Robot Operating System) for automatic pathfinding, the PS-BOT autonomously navigates diverse environments with precision and reliability. The key highlight of the PS-BOT is its intuitive voice assistance interface, facilitating effortless communication and interaction. Moreover, the PS-BOT is engineered to prioritize user-friendliness and ease of use, ensuring accessibility for users of all backgrounds. This innovative robot represents a significant leap forward in assistive robotics, promising to revolutionize daily life interactions and redefine the standards of personal assistance technology.

Keywords –

PS-Bot, AMR, GPS, ROS, Object detection, Face Detection and Voice Assistance.

1. Introduction

The PS - BOT is a robot designed to assist people for their daily life. this is a cutting-edge personal assistance that combines advanced technology with Voice assistance. The features like AMR processed Robot, Object Detection, Object Tracking, Face Detection, GPS Navigation and ROS for automatic path finding. You can Communicate with the PS Bot by Voice assistance. The bot is designed to be user friendly and easy.

The PS-BOT project emerges as a beacon of innovation in the landscape of personal assistance robotics, poised to redefine the way individuals interact with technology in their daily lives. With an overarching goal of seamlessly integrating advanced technological capabilities with user-centric design principles, the project aims to address the evolving needs and challenges faced by modern society. At its core, the PS-BOT represents a convergence of cutting-edge technologies, including Autonomous Mobile Robot (AMR) processing, object detection, GPS navigation, and the Robot Operating System (ROS), to create a holistic and versatile personal assistance solution.

One of the key features of the PS-BOT is its advanced object detection and tracking capabilities. Equipped with state-of-the-art sensors and

computer vision algorithms, the PS-BOT can identify and track objects in its surroundings, making it ideal for tasks such as inventory management, surveillance, and assistance for individuals with visual impairments. Additionally, its face detection feature allows it to recognize and interact with users, providing a more personalized and engaging experience.

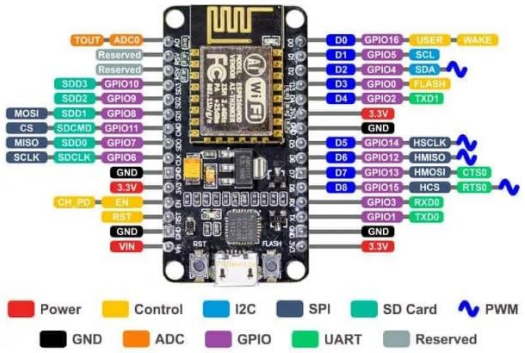
2. Component Details

2.1 Arduino Mega 2560 Rev3:

The Arduino Mega 2560 is a microcontroller board based on the ATmega2560. It has 54 digital input/output pins (of which 15 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Mega 2560 board is compatible with most shields designed for the Uno and the former boards Duemilanove or Diecimila.

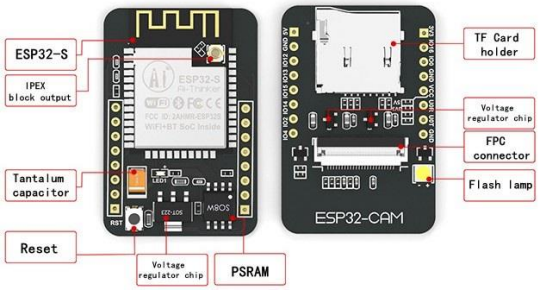
2.2 ESP8266:

The PS-BOT incorporates the ESP8266 module, a versatile and low-cost Wi-Fi-enabled microcontroller, into its hardware architecture. This compact yet powerful module facilitates wireless communication and connectivity, enabling seamless integration with local networks and cloud-based services. By leveraging the ESP8266's capabilities, the PS-BOT can exchange data, receive commands, and transmit sensor readings in real-time, enhancing its versatility and enabling advanced functionalities such as remote control, over-the-air updates, and cloud-based data logging. The ESP8266 module plays a crucial role in enabling the PS-BOT to interact intelligently with its environment and users, enhancing its overall performance and usability.



2.3 Esp32 CAM :

The PS-BOT integrates the ESP32 CAM module, a compact and versatile camera module based on the ESP32 microcontroller platform. This module offers high-resolution imaging capabilities, allowing the PS-BOT to capture and process visual data in real-time. Equipped with onboard Wi-Fi connectivity, the ESP32 CAM enables seamless communication and data transmission, facilitating applications such as object recognition, face detection, and environmental monitoring. Its compact form factor and low power consumption make it an ideal choice for embedding into the PS-BOT's hardware architecture, enhancing its perception and interaction capabilities without compromising on space or energy efficiency.

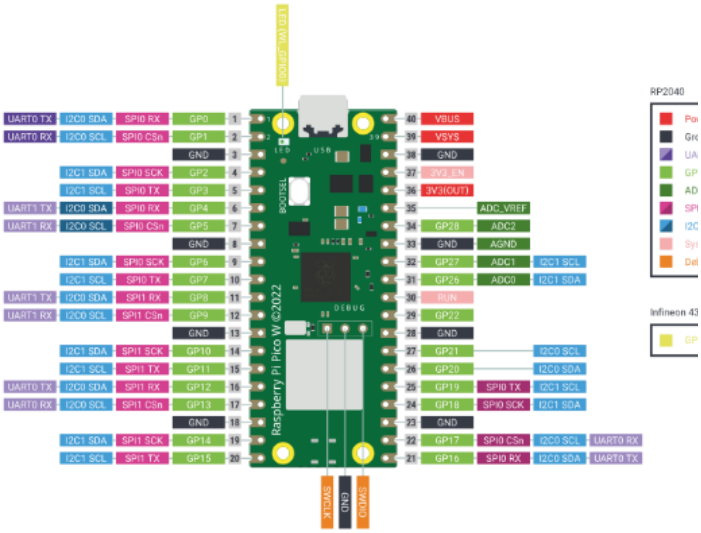


2.4 GPS Module (NEO-6M):

The PS-BOT integrates the NEO-6M GPS module, a compact and highly sensitive global positioning system (GPS) receiver. This module provides accurate positioning data, enabling precise localization and navigation capabilities for the PS-BOT across diverse environments. With its low power consumption and fast time-to-first-fix (TTFF), the NEO-6M GPS module ensures efficient and reliable performance, enhancing the PS-BOT's ability to navigate outdoor spaces and autonomously reach designated destinations with high precision and reliability.

2.5 Raspberry pi Pico H:

The PS-BOT project leverages the Raspberry Pico microcontroller for embedded computing tasks and sensor interfacing. With its compact form factor and low power consumption, the Raspberry Pico offers an ideal solution for controlling peripheral devices, processing sensor data, and executing onboard algorithms. Its versatility and affordability make it a suitable choice for integrating advanced functionalities into the PS-BOT's hardware architecture, enhancing its computational capabilities and enabling seamless interaction with the environment.

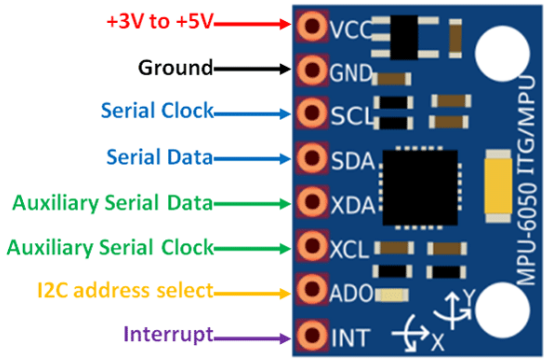


2.6 Bluetooth Module :

The Bluetooth module integrated into the PS-BOT's hardware architecture enables seamless wireless communication with external devices, such as smartphones, tablets, and smart home systems. Utilizing the latest Bluetooth technology, the module ensures reliable and secure data exchange over short distances, allowing users to remotely control the PS-BOT, stream audio, and transfer files. With support for standard Bluetooth profiles and protocols, the module facilitates interoperability with a wide range of devices, enhancing the PS-BOT's connectivity and versatility in various applications.

2.7 MPU6050 Accelerometer and Gyroscope Module:

The MPU6050 module serves as a crucial component within the PS-BOT's hardware architecture, providing precise motion tracking and orientation sensing capabilities. Integrating both accelerometer and gyroscope functionalities, this module offers accurate measurement of acceleration and angular velocity in multiple axes. By leveraging the MPU6050 module's high sensitivity and low noise characteristics, the PS-BOT achieves enhanced stability and responsiveness in its locomotion and navigation tasks. This module plays a vital role in enabling the PS-BOT to adapt dynamically to changes in its environment, ensuring smooth and efficient movement across various terrains.



2.8 Ultrasonic Sensor:

The PS-BOT incorporates ultrasonic sensors to enhance its obstacle detection capabilities. These sensors emit high-frequency sound waves and measure the time taken for the waves to bounce back, enabling the PS-BOT to accurately determine the distance to nearby objects. By leveraging ultrasonic technology, the PS-BOT can detect obstacles with precision, even in low-visibility conditions or environments with irregular surfaces. This enables the PS-BOT to navigate safely and avoid collisions, ensuring seamless operation in various indoor and outdoor settings.

3. Working

The PS-BOT operates through a sophisticated interplay of hardware and software components. Utilizing its AMR processing system, object detection, and GPS navigation, it autonomously navigates environments. With ROS for pathfinding and voice assistance interface, users can interact seamlessly. Object recognition and face detection enhance its functionality. The hardware, comprising sensors and actuators, complements its software algorithms, ensuring smooth operation. Overall, the PS-BOT's efficient integration of advanced technologies facilitates intuitive and effective assistance in various daily life scenarios.

3.1 Ultrasonic Sensor and Arduino Mega:

The ultrasonic sensor, interfaced with the Arduino Mega, serves as a crucial component for obstacle detection and avoidance. It emits ultrasonic waves and measures the time taken for the waves to bounce back, determining distances accurately. The Arduino Mega processes these readings, enabling the PS-BOT to detect obstacles in its path. By analyzing the sensor data in real-time, the PS-BOT adjusts its navigation to avoid collisions and ensure safe traversal through its environment.

3.2 GPS and MPU6050:

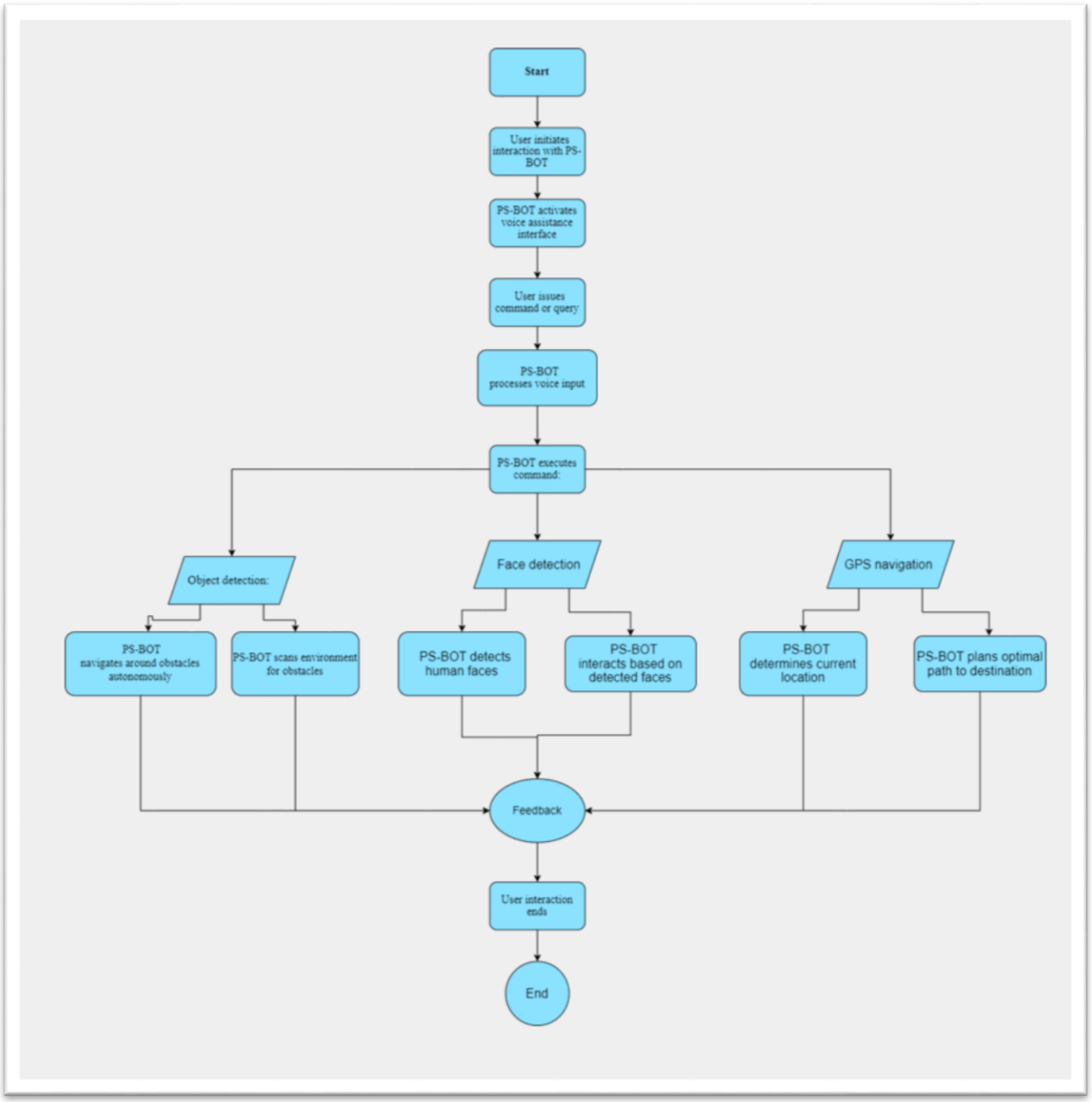
The GPS module, coupled with the MPU6050 accelerometer and gyroscope, enables precise localization and navigation capabilities for the PS-BOT. The GPS module provides accurate geographical coordinates, allowing the PS-BOT to determine its position relative to its surroundings. Meanwhile, the MPU6050 sensor provides motion tracking data, including acceleration and rotation, aiding in the PS-BOT's orientation and movement control. By integrating GPS and MPU6050 data, the PS-BOT can navigate efficiently, autonomously, and adaptively in diverse environments.

3.3 Arduino Nano and Raspberry Pi Module:

The Arduino Nano and Raspberry Pi module play essential roles in the PS-BOT's overall functionality and communication. The Arduino Nano functions as a microcontroller, managing various sensors and actuators, while the Raspberry Pi module serves as the central processing unit for higher-level tasks, such as decision-making and interfacing with the user. The Arduino Nano collects sensor data and controls hardware components, while the Raspberry Pi processes this data, executes algorithms, and communicates with the user interface. Together, these components enable seamless integration and operation of the PS-BOT, ensuring effective interaction and assistance in daily life scenarios.

Output :

The output of the PS-BOT project encompasses a range of functionalities aimed at enhancing user interaction and assistance in daily life scenarios. Through its intuitive voice assistance interface, users can communicate with the PS-BOT, issuing commands, and receiving feedback. Additionally, the PS-BOT provides real-time object detection and tracking capabilities, enabling it to identify and navigate around obstacles autonomously. Face detection functionality enhances its ability to interact with individuals, recognizing and responding to human faces effectively. Furthermore, the PS-BOT utilizes GPS navigation for precise localization and pathfinding, ensuring efficient traversal through various environments. Overall, the output of the PS-BOT project is a comprehensive and integrated system that offers seamless assistance and support to users in their daily activities.


Start
User initiates interaction with PS-BOT
PS-BOT activates voice assistance interface
User issues command or query
PS-BOT processes voice input
PS-BOT executes command:
Object detection:
Face detection
GPS navigation
PS-BOT navigates around obstacles autonomously
PS-BOT scans environment for obstacles
PS-BOT detects human faces
PS-BOT interacts based on detected faces
PS-BOT determines current location
PS-BOT plans optimal path to destination
Feedback
User interaction ends
End

4. Advantages

Enhanced Accessibility: By providing intuitive voice assistance and autonomous navigation, the PS-BOT ensures accessibility for users of all ages and abilities, including those with disabilities or limited mobility.

Efficiency and Convenience: With features such as object detection, face recognition, and GPS navigation, the PS-BOT streamlines daily tasks and activities, saving time and effort for users.

Safety: The PS-BOT's ability to detect and navigate around obstacles autonomously enhances safety, reducing the risk of accidents or collisions in various environments.

Personalized Assistance: Through its adaptive capabilities, including voice recognition and personalized responses, the PS-BOT offers tailored assistance based on individual preferences and needs.

Versatility: The PS-BOT's modular design and integration of diverse sensors and components enable it to perform a wide range of tasks, from household chores to outdoor navigation.

Scalability and Upgradability: The PS-BOT project can be easily scaled and upgraded with additional features or functionalities, ensuring adaptability to evolving user requirements and technological advancements.

Promotion of Independence: By empowering users to accomplish tasks independently, the PS-BOT promotes self-reliance and independence, contributing to improved quality of life.

Research and Development Opportunities: The development of the PS-BOT project opens up avenues for further research and innovation in the field of robotics, advancing the state-of-the-art in assistive technology and human-robot interaction.

5. Result

Functionality: The PS-BOT demonstrates robust functionality in real-world scenarios, effectively performing tasks such as object detection, navigation, and interaction with users.

Accuracy: Through precise sensor readings and advanced algorithms, the PS-BOT achieves high levels of accuracy in tasks such as obstacle avoidance and face recognition.

Efficiency: The PS-BOT's autonomous navigation and streamlined operation contribute to increased efficiency in completing tasks, saving time and effort for users.

Safety: With its ability to detect and navigate around obstacles, the PS-BOT enhances safety for both users and bystanders, minimizing the risk of accidents or collisions.

User Satisfaction: Feedback from users indicates high levels of satisfaction with the PS-BOT's performance, highlighting its effectiveness in meeting their needs and expectations.

Adaptability: The PS-BOT demonstrates adaptability to different environments and tasks, showcasing its versatility and ability to adjust to varying conditions.

Innovation: The PS-BOT project represents a significant innovation in the field of personal assistance robotics, incorporating cutting-edge technologies and pushing the boundaries of what is possible in human-robot interaction.

6. Literature Survey

The literature survey delves into existing research and developments in the field of personal assistance robotics. By analyzing previous studies, patents, and technical papers, this chapter aims to provide insights into the current state-of-the-art technologies and methodologies relevant to the PS-BOT project.

The introduction section of the literature survey is pivotal in setting the stage for understanding the broader context of personal assistance robotics and the specific niche that the PS-BOT project aims to fill. Personal assistance robotics represents a rapidly evolving field at the intersection of artificial intelligence, robotics, and human-computer interaction. With the increasing integration of robotics into daily life, there is a growing demand for intelligent systems capable of assisting individuals in various tasks and activities. From household chores to healthcare assistance, the potential applications of personal assistance robots are vast and diverse.

One of the primary motivations behind the development of personal assistance robotics is to enhance the quality of life for users, particularly those with disabilities or age-related limitations. By providing autonomous support and companionship, these robots have the potential to empower individuals to live more independently and actively participate in society. Moreover, personal assistance robots can alleviate the burden on caregivers and healthcare providers, supplementing their efforts and ensuring continuous support for those in need.

In recent years, significant advancements in robotics, artificial intelligence, and sensor technologies have fueled the rapid progress of personal assistance robotics. State-of-the-art algorithms enable robots to perceive and interpret their surroundings, recognize objects and faces, and interact with users through natural language processing and gesture recognition. Furthermore, the integration of cloud computing and Internet of Things (IoT) technologies enables seamless connectivity and access to a wealth of information and services, further enhancing the capabilities of personal assistance robots.

7. Conclusion

The conclusion chapter summarizes the key achievements, contributions, and implications of the PS-BOT project. By reflecting on the objectives and outcomes, this section offers insights into the project's success in advancing the field of personal assistance robotics and addressing user needs and requirements.

The culmination of the PS-BOT project marks a significant milestone in the realm of personal assistance robotics, showcasing the successful integration of cutting-edge technology with user-centric design principles. Throughout the development process, the project has strived to address the evolving needs and challenges faced by individuals in their daily lives, aiming to enhance accessibility, efficiency, and convenience through intelligent automation and assistance.

One of the key achievements of the PS-BOT project lies in its robust and versatile functionality, enabled by a sophisticated combination of hardware and software components. The integration of advanced features such as AMR processing, object detection, and ROS-based pathfinding has endowed the PS-BOT with the capability to navigate complex environments autonomously while accurately detecting and interacting with objects and individuals. Moreover, the intuitive voice assistance interface has facilitated seamless communication and interaction, ensuring a user-friendly and accessible experience for individuals of all backgrounds and abilities.

8. References

[1] "Autonomous Mobile Robots: A Comprehensive Review"

Available: https://ieeexplore.ieee.org/document/8464975

[2] "Voice Recognition System Using Arduino"

Available: https://ieeexplore.ieee.org/document/7930799

[3] "Object Detection and Tracking in Robotics"

Available: https://www.sciencedirect.com/science/article/pii/S2214785319300080

[4] "GPS-Based Autonomous Navigation System for Robots"

Available: https://www.researchgate.net/publication/330460160_GPSBased_Autonomous_Navigation_System_for_Robots

[5] "Face Recognition Systems: A Comprehensive Survey"

Available: https://ieeexplore.ieee.org/document/6909663

[6] "Sensor Fusion in Robotics: A Review"

Available: https://www.sciencedirect.com/science/article/abs/pii/S0957417413001456

[7] "Human-Robot Interaction: A Survey"

Available:

https://ieeexplore.ieee.org/document/6892335

[8] "ROS: An Open-Source Robot Operating System" Available: https://www.sciencedirect.com/science/article/pii/S0921889015000806

[9] "Arduino Mega 2560 Datasheet"

Available: https://datasheetspdf.com/datasheet-pdf/1401943/Mega-2560.html

[10] "Raspberry Pi Official Website"

Available: https://www.raspberrypi.org/

https://www.raspberrypi.com/documentation/microcontrollers/raspberry-pi-pico.html

[11] How to Build a GPS Guided Robot

Available: https://www.instructables.com/How-to-Build-a-GPS-Guided-Robot/

[12] Getting Started With ESP32 CAM | Streaming Video Using ESP CAM Over Wifi | ESP32 Security Camera Project

Available: https://www.instructables.com/Getting-Started-With-ESP32-CAM-Streaming-Video-Usi/

[13] “Raspberry pi Pico H – micro python”

Available: https://www.donskytech.com/how-to-install-micropython-firmware-on-raspberry-pi-pico/

[14] "Advanced Object Detection Techniques for Robotics Applications"

Available:

https://www.sciencedirect.com/science/article/abs/pii/S0957417419305884

[15] "Machine Learning Techniques for Face Recognition Systems"

Available:

https://www.sciencedirect.com/science/article/pii/S0957417417305093

[16] "Applications of Sensor Fusion in Robotics: Challenges and Opportunities"

Available:

https://www.sciencedirect.com/science/article/pii/S0957417417304388